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Patentanmeldung Nr. Patent application No. Demande de brevet n°

01440063.4

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

I.L.C. HATTEN-HECKMAN

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**Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation**

Anmeldung Nr.:
Application no.: 01440063.4
Demande n°:

Anmeldetag:
Date of filing: 12/03/01
Date de dépôt:

Anmelder:
Applicant(s):
Demandeur(s):
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Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:

Resource management in a wireless corporate communication system

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

Staat:
State:
Pays:

Tag:
Date:
Date:

Aktenzeichen:
File no.
Numéro de dépôt:

Internationale Patentklassifikation:
International Patent classification:
Classification internationale des brevets:

/

Am Anmeldetag benannte Vertragsstaaten:
Contracting states designated at date of filing: AT/BE/CH/CY/DE/DK/ES/FI/FR/GB/GR/IE/IT/LI/LU/MC/NL/PT/SE/TR
Etats contractants désignés lors du dépôt:

Bemerkungen:
Remarks:
Remarques:

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RESSOURCE MANAGEMENT IN A WIRELESS CORPORATE COMMUNICATION SYSTEM.

Background of the Invention

5 The present invention relates to a wireless corporate communication system and more precisely to resource management in such a wireless corporate communication system.

Usual wireless corporate communication systems allocate a predefined amount of resources on the radio interface for any call to be
10 established. Usually, this amount of resources correspond to one voice channel in case of a voice call or one data channel supporting the required bit rate in case of a data call. This resource allocation is performed once at call setup.

Moreover, calls entering the wireless corporate communication
15 system coming from a public communication network are allocated the same amount of resources in the wireless corporate communication system as in the public communication network. In this case, the resource allocation is transparent for the wireless communication network.

A drawback of this solution is that resources allocated on the radio
20 interface of the wireless corporate communication system do not exactly suit the requirements of the corporate radio terminals belonging to the wireless communication system. Indeed, the needs of a corporate radio terminal may vary during a communication while the resource allocated remains constant. This results in a poorly optimized load on the radio interface of
25 the wireless corporate communication system.

Another drawback is that the transparent allocation of resources for calls entering the wireless corporate communication system and coming from a public communication network is not optimized. Indeed, more resource may be available in the corporate network than in the public

network or on the contrary the amount of resources allocated in the public communication network may be higher than the resources available in the corporate communication system due to internal traffic in the corporate communication system.

5 A particular object of the present invention is to provide a wireless communication system allocating available resources to corporate radio terminals under the range of a base station coupled with a private branch exchange better taking into account the real needs of the corporate radio terminals.

10 Another object of the invention is to provide a private branch exchange to be used in a wireless corporate communication system as mentioned above.

Summary of the Invention

These objects, and others that appear below, are achieved by a
15 wireless corporate communication system according to claim 1, a private branch exchange according to claim 2, and a base station adapted to be coupled to a private branch exchange according to claim 7.

According to the present invention, the private branch exchange part of the wireless corporate communication system comprises means for
20 controlling the amount of resources allocated to a corporate terminal under the range of a base station coupled with the private branch exchange.

A wireless corporate communication system, according to the present invention, has the advantage to allocate more accurately available resources since a private branch exchange has a much better knowledge of
25 the needs of a corporate radio terminal than a public exchange would have.

Another advantage of a wireless corporate communication system according to the present invention is to better share the resources between the corporate communication system internal and external traffics.

Further advantageous features of the invention are defined in the dependent claims.

Brief Description of the Drawings

Other characteristics and advantages of the invention will appear on reading the following description of a preferred implementation given by way of non-limiting illustrations, and from the accompanying drawings, in which:

- Figure 1 shows a wireless corporate communication system according to the present invention;
- Figure 2 shows a private branch exchange according to the present invention.

Detailed Description of the Invention

Figure 1 shows a wireless corporate communication system according to the present invention. Wireless corporate communication system comprises a private branch exchange 11, a base station 12 coupled with private branch exchange 11 and corporate radio terminals 131, 132, 133 under the range of base station 12.

Wireless corporate communication system may be more complex in that it may comprise several base stations and/or several private branch exchanges. Preferably, a module for interfacing private branch exchange 11 with base station 12 is required. This further module may be considered as integrated to private branch exchange 11. In this case, base station 12 may be a base station adapted to be used in a public radio communication network.

For sake of simplicity, the invention will be explained by means of wireless corporate communication system as illustrated on Figure 1. Private branch exchange 11 is interconnected with a public communication network 14. Public communication network 14 may be a fixed or a wireless one e.g. PSTN, ISDN, GSM, GPRS, UMTS. This list is not exhaustive.

Preferably, wireless communication system 10 is adapted to deal with packet mode communication. In this case, resource allocation is a crucial function of the system. However, this invention may also be applied to circuit oriented communication as for example HSCSD (High Speed
5 Switched Circuit Data) applied to a wireless corporate communication system where up to eight radio channels can be simultaneously allocated to one single user.

According to the present invention, private branch exchange 11 comprises a resource allocation module responsible for controlling the
10 amount of resources allocated to the corporate radio terminals 131, ..., 133. For this purpose, private branch exchange 11 transmits a message to base station 12 indicating the amount of resources allocated to each new corporate radio terminal 131, ..., 133 setting up a new connection (in-band resource allocation). On its turn, base station 12 forwards this messages to
15 corporate radio terminals 131, ..., 133 indicating to each of them the amount of resources they are allocated.

The term resource should be understood as the bandwidth allocated to a corporate radio terminal 131, ..., 133 to communicate over the air interface. Then, the term resource may be a number of time slots
20 allocated in a TDMA (Time Division Multiple Access) frame or the number of switched circuits allocated simultaneously to a corporate radio terminal. Actually, the meaning of the term resources depends on the type of transmission on the air interface (e.g. TDMA/FDMA/CDMA as well as packet or circuit switched transmission).

25 Preferably, the resource allocation is dynamically updated i.e. the amount of resources allocated to a corporate radio terminal 131, ..., 133 can be increased or decreased at the initiative of private branch exchange 11 during a communication.

Alternatively, the resource allocation may also be controlled by means of a common channel to which each of the corporate radio terminal 131, ..., 133 has access (out-band resource allocation). This solution would be especially well adapted to TDMA transmission mode in wireless corporate communication system 10. The common channel could be divided in slots, each slot indicating the identity of the corporate radio terminal 131, ..., 133 that is allowed to transmit a packet in the next time slot. In this case, base station 12 fills the common channel with the indications contained in the messages received from private branch exchange 11.

Other usual methods for indicating to the corporate radio terminals how many resources they are allocated could also be used in the framework of the present invention.

In a preferred embodiment, different amount of resources may be allocated to a corporate radio terminal on the uplink (i.e. from the corporate radio terminal to the base station) and on the downlink (i.e. from the base station to the corporate radio terminal). Then, private branch exchange 11 should perform parallel computation of the amount of resources to be allocated in the two directions of communication.

In a further embodiment of the invention, resources can be allocated to a non-corporate radio terminal (i.e. not belonging to the wireless corporate communication system) located under the range of the base station 12 to enable access for this radio terminal to public communication network 14. In this case, a predefined default amount of resources should be allocated and this call is transparently routed to public communication network 14 through private branch exchange 11.

Private branch exchange 11 is responsible for calculating the amount of resources that should be allocated to the different corporate radio terminals.

Several embodiments for calculating the amount of resources will be presented in the following.

Figure 2 shows a private branch exchange 20 according to the present invention. Private branch exchange 20 comprises a switch 21, an interface 22 to public communication network 14, an interface 23 to base station 12, a profile data base 24, a module for allocating resources 25 and a module for sending messages indicating the amount of allocated resources.

Interface 22 is connected to switch 21 which is connected to interface 23. This is the structure of usual private branch exchange as known in the art. Switch 21 comprises the switching matrix as well as protocol conversion modules if the protocols used on both interfaces 22, 23 are different (e.g. GSM on interface 22 and DECT on interface 23 or GPRS on interface 22 and HSCSD on interface 23). Alternatively, switch 21 can be replaced by an IP router if the wireless communication system is based on the internet protocol.

According to the present invention, profile data base 24 comprises an entry for each of the corporate radio terminals belonging to the wireless corporate communication system. An entry may comprises fields such as the type of terminal (e.g. telephone, fax, computer), the type of data this terminal supports (e.g. voice, real-time data, packetized data...), the priority this terminal is given in the system (e.g. high priority for voice and real time data, a lower priority for packetized data).

The profile of a user may be very detailed. For example, the type of data and the priority of data may depend from the time. Then, if a data consolidation has to run at a predefined time of the day, the priority of these data may be very high at this time. Some other similar dependencies may be stored in the profile database 24.

This is made possible since a private branch exchange has a more precise knowledge of the corporate communication system than a Home Location Register storing the users profile in a public radio communication network would have from a user.

5 This profile data base 24 is connected to module 25 for allocating resources. This module manages the available resources (e.g. bandwidth, number of time slots,...) according to the needs of the different corporate radio terminals willing to communicate in the wireless corporate communication system. Module 25 for allocating resources runs an
10 algorithm that determines the amount of resources to be allocated to a corporate user depends on the profile of this user stored in the profile database.

 Preferably, the effective amount of data destined to a user received from a public communication network on interface 22 should also be taken
15 into account in the algorithm for allocating resources in module 25. This effective amount of data can be observed at switch 21 and accessed by module 25. Indeed, even if the resources allocated in the wireless corporate communication system is very high, a bottleneck in the public communication network may result in very few data to be received on this
20 interface (this would for example occur when downloading a file from the Internet at a corporate radio terminal). In such a case, module 25 for allocating resources may reduce the allocated resources to this corporate radio terminal until the amount of resources coming from the public communication network increases.

25 A similar problem also occurs in case of access to an intranet server or to any shared server that may be simultaneously accessed by several corporate radio terminals causing delay in the communication.

 Another criterion for allocating resources could be the load in the private branch exchange. This load can be determined by observing the

traffic at switch 21. When the traffic at the private branch exchange is low, more resources could be allocated to a corporate radio terminal trying to setup a connection than when the private branch exchange is very loaded.

Once the amount of resources to be allocated to a corporate radio
5 terminal has been calculated at module 25, a message containing an
identifier of the corporate radio terminal and the corresponding amount of
resources is generated at module 26 and sent on interface 23 to the base
station under the range of which the corporate radio terminal is located.
On its turn, the base station sends messages to the corporate radio
10 terminals indicating to each of them the amount of resources they are
allocated.

CLAIMS

1/ Wireless corporate communication system (10) comprising a private branch exchange (11), at least one base station (12) coupled with said private branch exchange (11), and a plurality of corporate radio terminals (131, 132, 133)
5 under the range of said base station (12), said corporate communication system (10) being characterized in that:

- said private branch exchange comprises means for controlling the amount of resources (25) allocated to each of said corporate radio terminals (131, 132, 133);
- 10 - said base station (12) comprising means for indicating to said corporate radio terminals (131, 132, 133) the amount of resources they are allocated.

2/ Private branch exchange (20) adapted to be coupled to a base station (12),
15 said private branch exchange (20) comprising a switch (21) establishing communications to/from corporate radio terminals located under the range of said base station, said private branch exchange (11) being characterized in that it comprises:

- means (25) for controlling the amount of resources allocated to each of
20 said corporate radio terminals;

- means (26) for sending messages to said base station comprising the amount of resources allocated to each of said corporate radio terminal.

- 3/ Private branch exchange (20) according to claim 2, characterized in that
5 said private branch exchange further comprises a database (24) storing user profiles of said corporate radio terminals; said amount of resources allocated to a corporate radio terminal depending on the profile of said corporate radio terminal stored in said database.
- 10 4/ Private branch exchange (20) according to claim 2, characterized in that said amount of resources allocated to a corporate radio terminal communicating with a public communication network over said corporate communication system depends on the effective amount of data destined to said corporate radio terminal and received at the interface (22) between said
15 corporate communication system and said public communication network.
- 5/ Private branch exchange (20) according to claim 2, characterized in that said amount of resources allocated to a corporate radio terminal depends on the amount of traffic in said private branch exchange.
20
- 6/ Private branch exchange (20) according to claim 2, characterized in that said amount of resources allocated to a corporate radio terminal is dynamically updated during a communication to/from said corporate radio terminal.
25
- 7/ Base station (12) adapted to be coupled to a private branch exchange (11) characterized in that it comprises a module sending messages to corporate radio terminals (131, 132, 133) under the range of said base station (12)

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indicating the amount of resources each of said corporate radio terminal (131, 132, 133) is allocated,
said amount o resources being determined by said private branch exchange (11).

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ABSTRACT

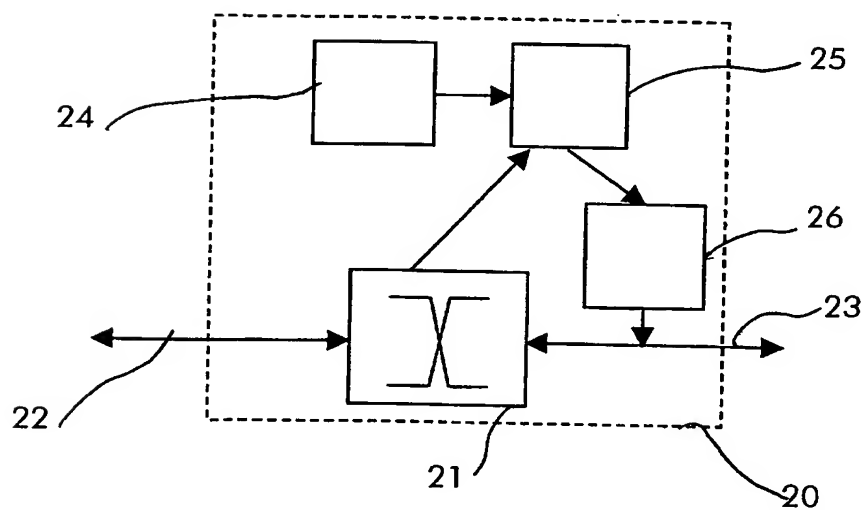
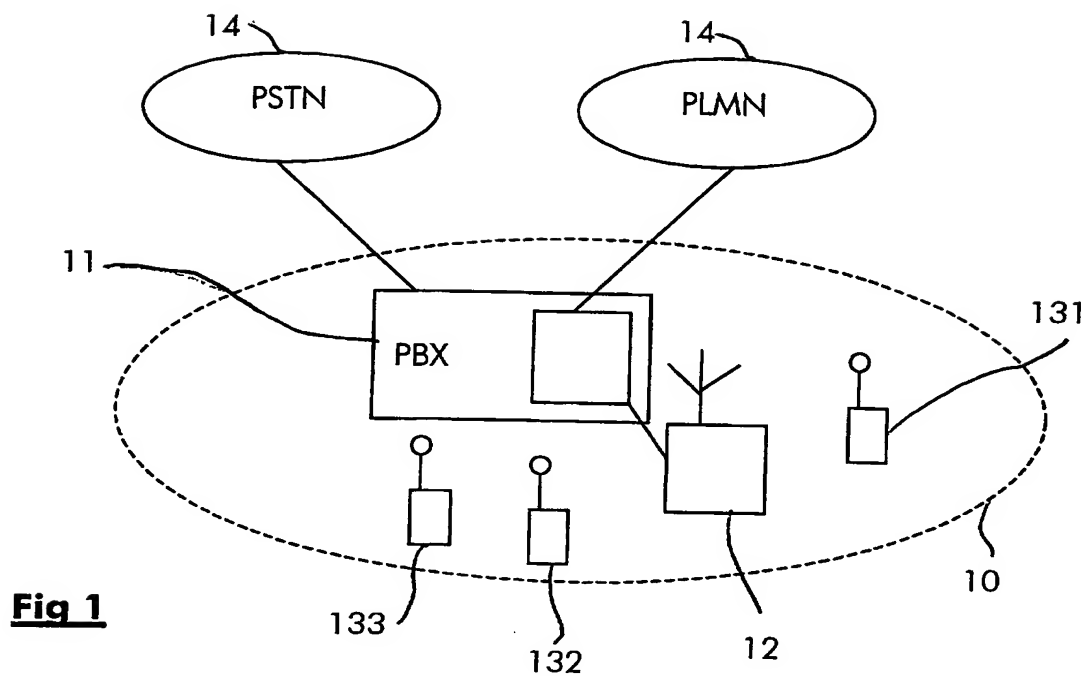
The invention relates notably to a wireless corporate communication system comprising a private branch exchange, at least one base station coupled with the private branch exchange, and a plurality of corporate radio terminals under the range of the base station,

According to the invention, the corporate communication system comprises means for controlling the amount of resources allocated to each of the corporate radio terminals, the base station comprising means for indicating to the corporate radio terminals the amount of resources they are allocated.

FIG. 1

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